METHOD FOR LITHOGRAPHIC PROCESSING ON MOLECULAR MONOLAYER AND MULTILAYER THIN FILMS

[0001] This invention was made with Government support under Contract No. DABT63-9-3-0003, awarded by the U.S. Army. The Government has certain rights in this invention.

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BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates generally to molecular electronic devices that can be utilized for memory storage, logic circuitry or signal routing. More specifically, the present invention relates to improved methods for making such devices wherein the critical dimensions of the devices are measured in nanometers.

2. Description of Related Art

[0003] Molecular electronic devices have been demonstrated to be capable of performing many of the same tasks that are commonly performed by semiconductor (e.g. silicon, gallium arsenide, etc.) devices. These tasks include signal rectification, signal switching and simple logic functions. Such devices are described in: "Molecular Wire Crossbar Logic" (U.S. Serial No. 09/282,045); "Molecular Wire Crossbar Interconnect" (U.S. Serial No. 09/280,225); "Demultiplexer for a Molecular Wire Crossbar Network" (U.S. Serial No. 09/282,049); "Chemically Synthesized and Assembled Electronic Devices" (U.S. Serial No. 09/292,767); and "Electrically Addressable Volatile and Non-Volatile Molecular Based Switching Devices (U.S. Serial No. 09/459,246). Molecular electronic devices are also described in United States Patents Nos. 6,128,214 and 6,159,620.

[0004] An advantage of molecular electronic devices is that the device performance characteristics originate from molecular properties. This has several implications. First, it means that the devices can potentially scale down in size to nanometer dimensions without significant change in device performance. Second, it also means that the unique electronic properties that can be designed into molecular structures can also be designed into solid state devices. These advantages are not characteristic of semiconductor devices. However, many molecular electronic devices that have been fabricated to date involve fairly awkward device processing steps. As one example of this awkward processing, electrical connections to the molecules are often evaporated through contact shadow masks, meaning that a thin metal foil that has been previously patterned with holes of various shapes is placed in contact with the molecular thin film and metal electrodes are deposited by directing a metal vapor through the open pattern. This technique has serious limitations in terms of the size resolution and complexity of electrode patterns that can be deposited. For example, it is